(19) JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: 56094939 A

(43) Date of publication of application: 31.07.81

(51) Int. Cl H02K 3/06
H02K 17/16

(21) Application number: 54170403

(22) Date of filing: 28.12.79

(71) Applicant: SHIBAURA ENG WORKS CO LTD

(72) Inventor: IRIE SHINICHIRO

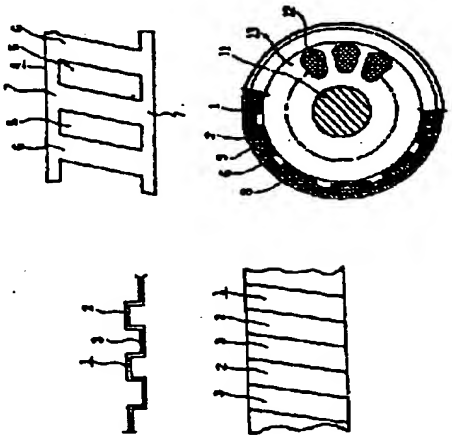
(54) ROTOR

(57) Abstract:

PURPOSE: To obtain easily a slender motor irrelevant to the diameter of the motor by a method wherein a steel plate is formed to be rectangular having convexes and concaves alternately in succession, and after the convex parts are inserted into slits being formed in a copper plate, the convex parts are crushed to hold the copper plate to hold the copper plates and curved to form a cylinder.

CONSTITUTION: The steel plate 1 is bent and is pr cessed to form the rectnagular shape having the convex parts 2 and the voncave parts 3 alternately in succession. At this time, it is favorable to make the bending parts between the convex parts 2 and the concave parts 3 to be skewed diagonally. On the other hand, the copper plate 4 having slits 5 to be fitted with the convex parts 2 is prepared, and the convex parts 2 of the steel plate 1 is inserted in the slits 5. After narrow tablet type steel plates 8 are inserted inside of the convex parts 2 and a steel plate 9 to constitute a yoke is made to come in contact with it, the top parts of the convex parts 2 are crushed to hold the conductor parts 6 of the copper plate 4. Finally it is wound around cylindrically making the steel plate 9 to be outside to obtain the rotor.

COPYRIGHT: (C)1981,JPO&Japio



(B3411)

Pat. Application Disclosure No. 56-94939 - July 31, 1981
Application No. 54-170403 - December 28, 1979
Applicant: K.K. Shibaura Seisakusho, Tokyo (JP)
Title: Rotor

Specification

1. Title of the Invention

ROTOR

2. Claim

A rotor characterized in that a steel plate is bent in a rectangular shape, a copper plate forming slits to which rectangular convex portions of said steel plate are fitted, respectively, is inserted in rectangular concave portions, an iron strip is placed in a back side of the convex portion, the convex portion is pressed and made flat so as to grip the copper plate, and the steep plate forming a yoke is brought into contact with the iron strip to be integrally formed and bent in a cylindrical shape.

3. Detailed Description of the Invention

The present invention relates to a structure of a rotor which is used for a narrow motor.

When an outer diameter of the motor is made small, it is necessary to form the motor long in the axial direction so as to obtain an output power. As a result, it becomes hard to machine the inner diameter side.

In particular, in a structure in which a coil is provided in an inner diameter side, a limit with respect to the assembling operations is the inner diameter. It is impossible to easily form

the structure narrow, so that unl ss the structure is longated even in the case of a cage rotor according to an aluminum casting, a molten metal does not sufficiently flow into an inner portion at a time of casting. Accordingly, there is a limit with respect of forming a secondary conductor.

According to such matters, there has been tried a structure in which a copper bar is employed for a secondary conductor in the case of the cage rotor, is inserted into an iron core slot, and is shorted in both sides of the iron core by using a copper ring. However, in this case, an operation of inserting and shorting a lot of copper bars is troublesome, and much labor is required for obtaining a balance in rotation after assembling.

The present invention is made by taking such matters into consideration, and an object of the present invention is to provide a rotor which can be easily assembled and manufactured without relation to the diameter.

A description will be given below of the present invention based on an embodiment shown in the accompanying drawings. Fig. 1 to Fig. 7 show an embodiment according to the present invention. Fig. 1 and Fig. 2 show a steel plate, Fig. 3 shows a copper plate, Fig. 4 shows an iron strip, Fig. 5 and Fig. 6 are views showing an assembly, and Fig. 7 is a vertical cross sectional view of a completed assembly.

In Fig. 1, a steel plate 1 is bent in a rectangular shape, and convex portions 2 and concave portions 3 are formed therein.

Then, as shown in Fig. 2, the steel plate 1 is formed with a fixed width and is bent in some diagonal rectangular shape for the purpose of forming a skew.

In Fig. 3, a copper plate 4 is provided with slits 5 which are fitted to the convex portions 2 of the steel plate 1, conductor portions 6 are formed between the slits 5, and short portions 7 are integrally formed in both ends of the conductor portions 6 so as to connect the conductor portions 6.

In Fig. 4, iron strips 8 are formed so as to be fitted to back sides of the convex portions 2 in the steel plate 1.

In Fig. 5, the steel plate 1 which is bent in a rectangular shape is mounted on a steel plate 9 forming a yoke, the strips 8 are provided in the back sides of the convex portions 2, and the conductor portions 6 of the steel plate 4 are provided in the concave portion 3.

Further, gaps 10 are formed between the strips 8 and the back sides of the convex portions 2.

In Fig. 6, the convex portions 2 of the steel plate 1 are pressed to the side of the steel plate 9 so as to be formed flat, and the conductor portions 6 of the steel plate 4 are gripped.

In Fig. 7, the rotor is formed in such a manner as to be bent in a cylindrical shape after the assembled state shown in Fig. 6 in a state of setting the steel plate 9 outside. The rotor is structured such that the convex portion 2 is set to an inner diameter side and the rotor rotates by a supporting structure (not shown).

Further, a stator 13, which is fixed to a shaft 11 and provided with a coil 12, is disposed in the inner diameter side of the rotor.

In this structure, the rotor is pressed flat as shown in Fig. 6 by forming the steel plate 1 in the rectangular shape as shown in Figs. 1 and 2, and placing the copper plate 4 and the iron strips 8 in the back sides of the concave portions 3 and the convex portions 2 respectively, as shown in Fig. 5.

Then, the cylindrical rotor is formed by bending in a cylindrical shape and connecting both ends by welding or the like.

The rotor formed in this manner can be optionally provided with a number of the slots based on a relation between the width of the rectangular shape at the time of forming the steel plate 1 in the rectangular shape and the diameter at the time of bending in the cylindrical shape, and also can be manufactured without

relation to the length in an axial direction. Accordingly, it is not an absolutely hard task to form elongated.

Further, with respect of manufacturing, the steel plate 9 forming the yoke can be manufactured by using a pipe material. In this case, the structure may be formed such that steel plate 4 and the strips 8 are integrally formed to be formed in the cylindrical shape and are inserted into the steel plate 9 formed by the pipe material.

Further, with respect to the accuracy of the rotor in the inner diameter side, the convex portions 2 and the like are squeezed against the cylindrical steel plate 9 formed in an outer side by applying a process of expanding in a radial direction from the inner diameter side according to an expand process or the like in the final step, whereby the accuracy as the rotor can be obtained.

Further, the rotor can be similarly employed in an internal rotation type motor by setting the convex portions 2 to an outer side at the time of bending in the cylindrical shape, in addition to an external rotation type motor according to the present embodiment.

The rotor of this kind becomes flat in the circumferential direction so as to grip the copper plate 4 at the time when the convex portions 2 are pressed flat, and an opposing area of the steel plate 1 with respect to the stator is expanded. Accordingly, it is possible to improve the efficiency. Further, since the short portion 7 of the conductor portion 6 is previously formed so as not to require reworking, and it is possible to uniformly manufacture with no difficulty in forming the skew, it is possible to obtain a motor which is extremely preferable in view of the electric characteristics.

Further, the skew can be formed in the side of the rotor, however, the structure can be made such that the skew is formed in the side of the stator 13 and is not formed in the rotor.

Showing one embodiment of a size which is advantageous in the case of forming the rotor according to the present embodiment, SPC-C having a thickness of 0.5 mm is employed for the steel plate 1, the steel plate 4 has a thickness of 4 mm, the iron strip 8 has a thickness of 2 mm, the steel plate 9 forming the yoke has a thickness of 1.6 mm, and the rotor has about 10 slots. According to this structure, it is possible to form the rotor having an efficiently small diameter.

As described above, according to the present invention, it is possible to easily structure the rotor having an extremely small diameter. Also, it is possible to achieve a high efficiency without deteriorating the electric characteristics and it is possible to optionally elongate in the axial direction. Therefore, it is possible to obtain an elongated motor which has not been achieved in the conventional art, and this effect is highly appreciated in industry.

4. Brief Description of the Drawings

Figs. 1 to 7 are views showing a rotor according to an embodiment of the present invention, in which Figs. 1 and 2 are views of a steel plate, Fig. 3 is a view of a copper plate, Fig. 4 is a view of an iron strip, Fig. 5 and Fig. 6 are view showing an assembling state, and Fig. 7 is a vertical cross sectional view of a motor using a rotor.

1 ... steel plate
2 ... convex portion
3 ... concave portion
4 ... copper plate
8 ... strip
9 ... steel plate
13 ... stator

⑲ 日本国特許庁（JP）　　⑪ 特許出願公開

⑫ 公開特許公報（A）　　昭56—94939

⑤Int. Cl.³	識別記号	庁内整理番号
H 02 K 3/06		6728—5H
17/16		7319—5H

⑬公開　昭和56年(1981)7月31日

発明の数　1
審査請求　未請求

（全 4 頁）

⑭回転子

小浜市駅前町13番10号株式会社芝浦製作所小浜工場内

⑪出　願　人　株式会社芝浦製作所
東京都港区赤坂1丁目1番12号

⑳特　　願　昭54—170403
㉒出　　願　昭54(1979)12月28日
⑫発　明　者　入江真一郎

明　　細　　書

1 発明の名称

回転子

2 特許請求の範囲

鋼板を矩形状に曲げると共にこの矩形の凸部が嵌合するスリットを形成した鋼板を矩形の凹部に数枚し、かつ前記凸部の裏側に鉄の短冊を数設し、さらに前記凸部を押圧し偏平にして前記鋼板を把持し、前記鉄の短冊に継鉄を形成する鋼板を当接し一体にし円筒状に曲げて形成したことを特徴とする回転子。

3 発明の詳細な説明

本発明は、細形モータに用いる回転子の構造に関する。

モータの外径を小さくすると出力を得るに軸方向に長く形成しなければならず内径側の加工が難しくなる。

特に、内径側に巻線が施されるものについては組立作業上の限界が比較的大きな内径にあつて容易に細形に形成することができず、アルミ鋳造によるカゴ形回転子の場合でも細長くなければ鋳造の際に湯が十分内部まで流れず二次導体の形成上限界があつた。

この様な事情から、カゴ形回転子の場合の二次導体に銅製のバーを用いて鉄心スロットに挿入し鉄心の両側で銅環を用いて短絡するものが試みられているが、多数の銅バーを挿入し短絡する作業が面倒であり、組立後も回転のバランスを得るに手間であつた。

本発明は、この様な事情に鑑みてなされたものであり、径に関係なく容易に組立製作の行える回転子を提供することを目的としている。

以下、本発明を図面に示された一実施例に基づいて説明すると第1図～第7図は、本発明の一実施例であり、第1図及び第2図は鋼板，第3図は鋼板，第4図は鉄の短冊，第5図及び第6図は組立を示す図，第7図は組立完成した縦断面図である。

第1図に於いて、鋼板1は矩形状に曲げられており、凸部2及び凹部3が形成されている。

そして、第2図に示される通り、鋼板1は一定の幅に形成されると共にスキューを形成するためにいくらか斜めの矩形状に曲げられている。

第3図に於いて、銅板4は、鋼板1の凸部2に嵌合するスリット5を備えスリット5の間に導体部6が形成され、この導体部6を接続するよう短絡部7が導体部6の両端に一体に形成されている。

第4図に於いて、鉄の短冊8は、鋼板1の凸部2の裏側に嵌合されるよう形成されている。

第5図に於いて、継鉄を形成する鋼板9に矩形状に曲げられた鋼板1が載置されており凸部2の裏側に短冊8，凹部3に銅板4の導体部6が敷設されている。

そして、短冊8と凸部2の裏側との間には隙間10が形成されている。

第6図に於いて、鋼板1の凸部2が鋼板9側へ押圧し偏平に形成されており、銅板4の導体部6が把持されている。

第7図に於いて、回転子は、第6図に示された組立状態から鋼板9を外側にして円筒状に曲げら

形しておき管材で形成された鋼板9に挿入して構成すればよい。

そして、回転子の内径側の精度は、最終工程でエキパンド処理等内径側より半径方向に広げる等の処理を施せば外側に形成される円筒状の鋼板9との間で凸部2等が圧潰され回転子として精度を得ることができる。

さらに、回転子は、本実施例の如く外回転型のモータの他、円筒に曲げる際凸部2を外側にして内回転型のモータを形成するものにも同様に採用できる。

この様な回転子は、凸部2が押圧偏平する際銅板4を把持するよう周方向へ偏平になり固定子に対する鋼板1の対向面積が拡大されるため効率を向上することができ、しかも導体部6の短絡部7があらかじめ形成されており後加工が不要であり、スキューの形成に全く困難がなく均一に製作することができるため電気的特性上極めて好ましいモータを得ることができる。

また、スキュー形成は、回転子側で形成するこ

れて形成されており、凸部2が内径側になり、図示されない支持構造によつて回転するよう構成されている。

そして、軸11に固定され巻線12が施された固定子13が回転子の内径側に設けられている。

この様な構成に於いて、回転子は、鋼板1を第1図及び第2図に示される通り、矩形状に成形し、第5図に示される通り、銅板4及び鉄の短冊8を夫々凹部3及び凸部2の裏側に敷設し第6図に示される通り押圧偏平にする。

そして、円筒状に曲げ両端を溶接等で接合し円筒状の回転子を形成する。

この様に形成される回転子は、鋼板1を矩形に成形する際の矩形々状の幅と円筒状に曲げた際の径との関係によつてスロット数を任意に設けることができる他、軸方向の長さに無関係に製作できるため細長く形成するに全く困難がない。

また、製作上、継鉄を形成する鋼板9について管材を用いて製作することもでき、この場合鋼板1と鋼板4及び短冊8とを一体にして円筒状に成

とも可能であるが、固定子13側で形成し、回転子には形成しないことも可能である。

本実施例により回転子を形成する場合、好都合な寸法の一例を示すと、鋼板1に0.5mm厚のSPC－C，銅板4に4mm厚，鉄の短冊8に2mm厚，継鉄を形成する鋼板9に1.6mm厚のものを採用し、10スロット程度の回転子を構成すれば効率のよい小径の回転子を形成することができる。

以上説明の通り、本発明によれば、極めて小さい径の回転子を容易に構成することができ、しかも電気的特性を悪化させることなく高効率であり、軸方向へ任意に長くすることができるため従来にない細長い形状のモータを得ることができるものでありこの効果は産業上大である。

4図面の簡単な説明

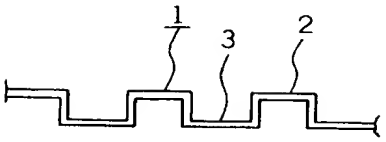
第1図～第7図は本発明の一実施例による回転子を示す図であり、第1図，第2図は鋼板の図，第3図は銅板の図，第4図は鉄の短冊の図，第5図及び第6図は組立の状態を示す図であり、第7

図は回転子を用いたモータの縦断面図である。

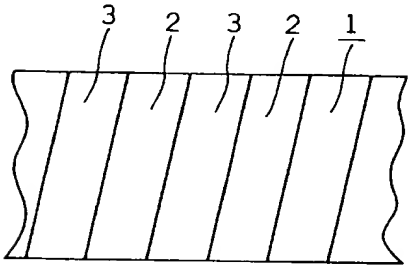
1・・・鋼板，　2・・・凸部，　3・・・凹部，　4・・・鋼板，　8・・・短冊，　9・・・鋼板，　13・・・固定子。

特許出願人
株式会社 芝浦製作所
代表者 松本文次

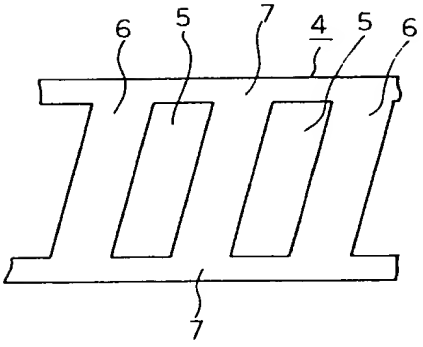
第1図



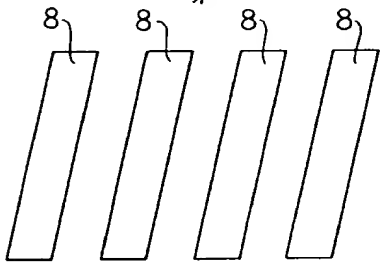
第2図



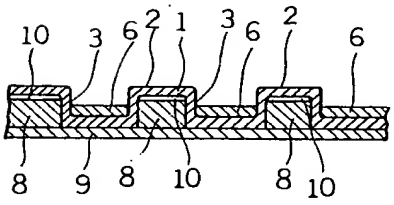
第3図



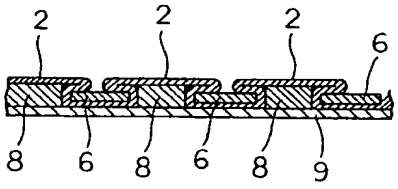
第4図



第5図



第6図



第 7 図